

STEPHEN TOULMIN

THE HERMENEUTICS OF THE NATURAL SCIENCES

One of the most creative transitions in twentieth-century philosophy is explicitly recorded only in a footnote to an appendix to a translation into English of Hans-Georg Gadamer's book, *Wahrheit und Methode*. The obscurity of this reference conceals the fact that this transition was the work of Patrick Heelan. It was he who succeeded in showing Gadamer, against the widespread academic opinion, that the intellectual operations of the natural sciences embody indispensable elements of interpretation that make them effectively "hermeneutic." To this day, scholars of the Frankfurt School – I have in mind particularly Karl Otto Apel and Albrecht Wellmer, with whom I have debated this point at the New School of Social Research – assume the essential rightness of a naïve positivism in the philosophy of natural science, and use it to support a hard line opposition between Physics on the one hand, and History, or Sociology, on the other. Patrick Heelan has always been careful to avoid that oversimplification, and my aim in this paper is to ask why, despite his good example, so many of our colleagues are still tempted to go down this cul-de-sac.

To come straight to the central point: the key to understanding the sources of this error can be found in a familiar way of reading Wilhelm Dilthey. Many readers take Dilthey's emphasis on the hermeneutic character of History, Sociology, and Political Theory as a sign that he regarded Physics (say) as studying more-or-less objective facts, and so as being free of the subjective interpretations that were the concern of hermeneutic philosophy. Historians, on this account, could not escape from slanting their narratives in ways that reflect their backgrounds or interests, whereas physicists who let their backgrounds or interests influence their analysis of natural phenomena would be condemned for betraying the rational claims and methods of their subject.

The charm of this reading is clear enough, but it does not tell the whole story. If Apel's position needs to be related to Dilthey's, Dilthey himself must be understood in his relation to Kant. No one would suggest for a moment that Kant's view of the physical sciences was positivistic in its tone or its conclusions. On the contrary, the whole project of his three *Critiques* started from his belief that neither rationalists nor empiricists could give an adequate account of the reason for the intellectual success of Newton's *Principia*, and his own account of the operations of *reasone Vernunft* was a preparatory move toward a hermeneutics of physics.

What distinguished Kant's position in the first *Critique* from the general views current today is the fact that Kant saw Euclid and Newton's world-picture as having a unique authority, to which there was no alternative compatible with the structure of our experience of the world. To put this point in a phrase: Euclid and Newton had defined the only hermeneutic standpoint for geometry and physics, and so made it unnecessary to explore alternative standpoints. This does not, of course, imply that the question of "alternative standpoints" did not make sense for Kant. Through his mathematical friends, e.g., Lambert, he was quite aware of the formal possibility of non-Euclidean geometries, and it was precisely for this reason that synthetic *a priori* knowledge became an active problem for him: otherwise, there was no objection to viewing Euclidean geometry as analytic rather than synthetic – an option Saccheri had swept off the table.

In his own approach to scientific theory, Kant avoided both any claim to outright objectivity and any retreat into a pure subjectivity. That is the reason why he called our understanding of the Order of Nature *intersubjective*: Pure Reason leads us all to organize experience in terms of a shared interpretive framework. The uniqueness of the Euclidean and Newtonian systems thus depends, not just on their contribution to physics, in the twentieth-century sense of an empirical science, but also on their role in shaping the framework of sensory experience. So any reading of Kant's theories as creating a possibility for different frameworks of experience would be foreign to his view. Still, Euclid and Newton do not report "facts" just as they stand: they fit our observations into a rationally coherent picture of Nature. Starting when he did, then, Wilhelm Dilthey could assume that all questions about the status of geometry and physics had been settled by Kant's demonstration of their singular hermeneutic standpoint. His own philosophical task was to show how and why the human sciences, unlike physics and geometry, have multiple standpoints.

Once again, there is a risk of falling into an idea that these standpoints introduce an extreme subjectivity into our interpretation of other people's actions, whether now or in the past. But this too is a mistake. Dilthey's alternative historical standpoints are shared by many people, as much as Kant's unique standpoint of Euclid and Newton. Dilthey's point is not that our interpretations are personal, but that they vary with our other connections and commitments. In this respect, his views paved the way for the position set out in (e.g.) Jürgen Habermas's *Knowledge and Human Interests*.

Given his time working with Schrödinger at the Institute for Advanced Studies in Dublin, Patrick Heelan would be the last person to think that the structure of physical theory is independent of human interpretation, yet also the last person to think that the world as we know it admits of only one such mode of interpretation. In the context of this paper, therefore, it will be helpful to map some of the different ways in which, intentionally or otherwise, scientific theories can be hermeneutic in effect.

At its weakest, the initial contest from 1927 on between Erwin Schrödinger's wave mechanics and Werner Heisenberg's quantum mechanics to be the foundation for a post-Newtonian union of Matter and Energy might be so regarded; but it was soon demonstrated that, whatever intellectual models the two theories suggested, they are mathematically equivalent, and the difference of standpoint is in some respects merely linguistic. Remaining within the physics of the early and mid

twentieth century, too, we may view Niels Bohr's idea of Complementarity as a hermeneutic move, and this reading is reinforced by Gerald Holton's suggestion that Bohr was prompted in this direction by memories of childhood discussions at the Bohr family Sunday luncheon table about Kierkegaard's *Either / Or*, with its contrast between (say) the aesthetic and ethical standpoints in life. But this comparison overstates the force of the physical contrast involved. Despite initial bewilderment among physicists in the early 1920s, there was (Schrödinger and Heisenberg proved) no direct conflict between the wave and particle wave aspects of subatomic phenomena. So, on its own level, the belief that these two theoretical models are complementary was not an unreasonable way to make Bohr's point, but the residual differences between them are far less significant than those that were at issue for Kierkegaard himself.

If we are to find a greater intellectual contrast within the fundamental physics of the mid twentieth century, then, it is the argument about the scope of Causality in quantum physics between Niels Bohr and the Copenhagen School on the one hand, Albert Einstein and his supporters on the other. As many readers will remember, the thing about orthodox quantum mechanics that Einstein could never stomach was the argument that we can solve its equations of motion and change only statistically and probabilistically. To accept that limitation would be to abandon the central mission of physics, and imply that the Creator fashioned the Order of Nature in such a way that its workings were radically indeterminate. Hence Einstein's dictum that God does not play with dice: *Raffiniert ist der Herr Gott, aber boshaft ist er nicht!* ("The Lord God is refined, but he is not malicious!") In return, Bohr and his school criticized Einstein for clinging to an outdated view of Causality. If probabilistic explanations alone were on offer, so be it: insisting on classical Newtonian explanations was sentimentality. Einstein's scruples passed to another generation. In particular, having written the standard textbook of quantum mechanics, David Bohm spent a lot of time looking for hidden variables on a sub-quantum level, without much success, and finally took up a new mission searching for a deeper compromise – as Schrödinger himself had done with the Vedanta – in Eastern Philosophy.

The richest examples of multiple hermeneutic standpoints in the natural sciences are to be found, however, not in physics but in the biological sciences. I here say "the biological sciences" rather than "biology" for good reason. In his Romans Lecture at Oxford in 1953, for example, the theoretical biologist, J.B.S. Haldane, surveyed the conceptual systems used in one or another branch of biology, and spoke about the multiple levels on which biological explanations are typically given. His lecture was called "Time in Biology" and analyzed the scales of Space and Time on which the biological sciences theorize about living things. In doing so, he showed that the varied fields of biological explanation are conceptually independent in ways that make it impossible to "reduce" any one field to another one.

The most basic processes studied in contemporary biophysics and biochemistry, for instance, take place on the level of individual macromolecules, in special niches within particular organs. They involve mechanical interactions and/or biochemical reactions that may be both minute and swift, and apparently conform to all the same physical and chemical patterns as they follow outside the organism, on a laboratory bench: as Claude Bernard put it, they exemplify the operation of physical and chemical laws "in the special field of Life." The things that give these processes

their additional, physiological characteristics are the special “*niches*” that exist within the body.

On a second level, physiologists study the ways in which the functioning or malfunctioning of bodily organs and systems affects the health and survival of the entire organism. Here, of course, the scales of space and time are those relevant to normal life-size living things with life cycles that range up to a hundred years or so. Notice that the basic terminology of physiology is functional rather than physical: in particular, it can make no claim to be value-free, as it is concerned with the right functioning and/or malfunctioning of the organs and systems in question. To study mechanical and chemical processes in those organs helps throw light on the success of these bodily functions, but no formal definitions link the functional language of physiology with the structural language of biophysics and biochemistry.

On two further levels, Haldane distinguishes the terminology and subject matter of morphogenesis and the overall life-cycle, and the terminology and subject matter of organic evolution, in turn, from processes and functions on the smaller scale levels of biochemistry and physiology. Developmental biology is concerned with changes of function over time, in the life cycles of typical individuals, and evolutionary biology is concerned with changes in the distribution of observable characteristics, within the populations that make up different species. Once again, these further kinds of study have distinct terminologies, and select their objects of investigation in ways that are logically independent of all the other biological sciences.

If we are to think of “hermeneutics” as concentrating on differences among the interpretations of texts and/or situations, as considered from the standpoints of people who approach those texts and situations with different backgrounds and interests, Haldane’s biological examples are among the most clearly “hermeneutic” to be found in the natural sciences, as these are known in the Western World. Other examples with a cross-cultural basis are, however, worth mentioning here. In our experience of Time, for instance, we use for the Seasons names such as Spring or Fall, which reflect their agricultural significance. In the United States, by contrast, Spring and Fall are understood as fixed parts of a four-fold year, which is defined and divided up by astronomical calculations. It makes no clear sense, from this second point of view, to say (e.g.) “Spring came late this year”: that represents a switch back from astronomy to agriculture, which we are liable to take unthinkingly.

Again, in the current discussions of Traditional Chinese Medicine – acupuncture and the rest – it turns out that traditional healers approach the body with a view of its make-up and workings very different from a standard mechanical Western account of the matter. These differences are of two kinds. They are undergirded by no system of theory recognized in the West: instead, they are more practical than theoretical in their implications. Chinese healers thus speak of the body’s workings not in terms of material processes governed by laws, but of patterns of energy that are manipulated in acupuncture (say), and in suitable cases their procedures seem effective. Scientists who approach the behavior of living things, and their associated phenomena, with the concepts and questions in their minds that derive from different fields of biological science may, thus, provide the purest illustration of “scientific hermeneutics” now available.

If we make a further move on, to consider the additional factors introduced by mentality and/or culture – either animal or human – we enter fields of psychology and anthropology in which scarcely any one will call the hermeneutic differences in question. Only an arbitrary insistence that language-using humans alone can take up standpoints or present interpretations that are hermeneutically distinct can compel us to deny the possibility of “hermeneutics” in the sciences, too. If, on the other hand, people hesitate to extend the scope of “hermeneutics” to Bohr’s complementarity, or to the rivalry between Schrödinger and Heisenberg, their scruples may be justified.

As a general matter, disputes about the make up and interpretation of quantum physics are conducted in terms that quite often shift with the discovery of mathematical or empirical equivalences in both their form and content, as a result of which we can move freely from one position to another without change of meaning. It would be interesting to know, in this connection, how far Patrick Heelan’s association with Erwin Schrödinger led him to see these disputes in and around quantum physics as also being “hermeneutic” in nature.

To sum up: like so much in the history of philosophical hermeneutics, the desire to limit “hermeneutics” to history and the human sciences had its origins in a reading of Immanuel Kant’s *Critiques*. Kant’s works had one thing in common with the Vienna Circle philosophers of science in the inter-War years, and with their logical empiricist successors in the United States from the late 1920s on: *viz.*, the ambition to show that all of the mathematical sciences could be accommodated within a single logical system, which was the goal of the twentieth century campaign to establish the comprehensive, formally integrated scientific theory known as the Unity of Science Movement. The equation of “pure reason” with “logicality” was particularly evident in the latter campaign; but, in both cases, one basic conviction was the existence of a unique framework of concepts to served as foundation of all our formal and empirical knowledge of nature, whose validity was not demonstrable in “analytic” terms alone – hence, the problem of “synthetic” *a priori* knowledge again.

So long as we continue to take as proven the existence of this unique conceptual foundation – whether rooted in Euclid and Newton in Kant, or Russell and Einstein for the *Wiener Kreis* – we risk trapping ourselves in dogmas that we may later regret. Once emancipated from this assumption, we are free to go a hundred ways, and the idea of alternative hermeneutic standpoints is essentially liberating. As Wittgenstein once remarked, though in a quite different context: “Does this sound like nonsense? Well, talk a little nonsense for a change – Language is not a Cage!”

University of Southern California

Hermeneutic Philosophy of Science, Van Gogh's Eyes,
and God

Essays in Honor of Patrick A. Heelan, S.J.

Babich, B. (Ed.)

2002, XVIII, 500 p., Hardcover

ISBN: 978-1-4020-0234-2